

What is claimed is:

1. A synchronization establishing and tracking circuit for a CDMA base station comprising:

a first spreading code generator generating a first spreading code sequence;

a first correlator calculating first correlation between said first spreading code sequence and a first quasi-coherent signal corresponding to a first received signal received by said CDMA base station;

10 a second spreading code generator generating a second spreading code sequence;

a second correlator calculating second correlation between said second spreading code sequence and a second quasi-coherent signal
15 corresponding to a second received signal received by said CDMA base station; and

a phase determining circuit determining a first phase of said first spreading code sequence based on an added quasi-coherent signal to which
20 said first and second quasi-coherent signals are added.

2. A synchronization establishing and tracking circuit according to claim 1, wherein said phase determining circuit includes:

a ranking portion determining a plurality

Sub
02

11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000

5 of target phases based on said added quasi-coherent signal; and

a phase setting circuit setting said first phase to a selected phase selected from among said target phases.

3. A synchronization establishing and tracking circuit according to claim 2, wherein said ranking portion determines an order of priority for said target phases based on said added quasi-coherent signal, and

wherein said phase setting circuit selects said selected phase in accordance with said order of priority.

4. A synchronization establishing and tracking circuit according to claim 2, wherein said ranking portion comprises:

a phase determining spreading code generator generating a phase determining spreading code sequence, wherein a phase of said phase determining spreading code sequence is sequentially shifted to one of candidate phases;

a phase determining correlator calculating correlation between said phase determining spreading code sequence and said added quasi-coherent signal to determine added signal

correlation values respectively corresponding to said candidate phases;

15 a ranking circuit selecting said target phases based on said correlation values.

5. A synchronization establishing and tracking circuit according to claim 1, further comprising:

 a maximum correlation phase determining circuit determining a despreading phase based on
5 said first correlation;

 a despreading circuit despreading said first quasi-coherent signal to produce a despread signal using another spreading code sequence having said despreading phase; and

10 a synchronization detecting circuit detecting a synchronization of said first quasi-coherent signal with said another spreading code sequence to output a synchronization informing signal informing said first spreading code
15 generator of said synchronization, wherein said first spreading code generator fixes said first phase based on said synchronization informing signal such that said synchronization of said first quasi-coherent signal with said despreading
20 spreading code sequence is established.

6. A synchronization establishing and tracking

circuit according to claim 1, wherein said phase determining circuit determining a second phase of said second spreading code sequence based on said
5 added quasi-coherent signal.

7. A synchronization establishing and tracking circuit according to claim 6, wherein said a phase determining circuit includes:

a ranking portion which determines a
5 plurality of target phases based on said added quasi-coherent signal; and

a phase setting circuit setting said first and second phases to a selected phase selected from among said target phases.

8. A synchronization establishing and tracking circuit according to claim 7, wherein said ranking portion determines an order of priority for said plurality of target phases based on said
5 added quasi-coherent signal, and

wherein said phase setting circuit selects said selected phase in accordance with said order of priority.

9. A synchronization establishing and tracking circuit according to claim 7, wherein said ranking portion comprises:

a phase determining spreading code
5 generator generating a phase determining
spreading code sequence, wherein a phase of said
phase determining spreading code sequence is
sequentially shifted to one of candidate phases;

a phase determining correlator calculating
10 correlation between said phase determining
spreading code sequence and said added quasi-
coherent signal to determine added signal
correlation values respectively corresponding to
different phases of said candidate phases;

15 a ranking circuit selecting said target
phases based on said correlation values.

10. A synchronization establishing and tracking
circuit according to claim 1, further comprising:

a first maximum correlation phase
determining circuit determining a first
5 despreding phase based on said first
correlation;

a first despreding circuit despreding
said first quasi-coherent signal to produce a
first despread signal using a third spreading
10 code sequence having said first despreding
phase;

a second maximum correlation phase
determining circuit determining a second

despreading phase based on said second
15 correlation;

a second despreading circuit despreading
said second quasi-coherent signal to produce a
second despread signal using a fourth despreading
spreading code sequence having said second
20 despreading phase; and

a space diversity circuit identifying a
direction of a mobile station transmitting at
least one of said first and second received
signals, based on said first and second despread
25 signals.

11. A synchronization establishing and tracking
circuit for a CDMA base station comprising:

a spreading code generator generating a
spreading code sequence;

5 a correlator calculating correlation
between said spreading code sequence and a quasi-
coherent signal corresponding to a received
signal received by said CDMA base station;

a ranking circuit storing a plurality of
10 ranked phases; and

a phase setting circuit setting said phase
to a selected phase selected from among said
plurality of ranked phases.

12. A synchronization establishing and tracking circuit according to claim 11, further comprising:

an adding circuit adding said quasi-
5 coherent signal and at least one other quasi-coherent signal to produce an added quasi-coherent signal, wherein said other quasi-coherent signal corresponds to one or more other received signal received by said CDMA base
10 station, and

wherein said plurality of ranked phases are determined based on said added quasi-coherent signal.

13. A synchronization establishing and tracking method for a CDMA base station comprising:

generating a first spreading code sequence;
calculating first correlation between said
5 first spreading code sequence and a first quasi-coherent signal corresponding to a first received signal received by said CDMA base station;
generating a second spreading code
sequence;
10 calculating second correlation between said second spreading code sequence and a second quasi-coherent signal corresponding to a second received signal received by said CDMA base

station;

15 producing an added quasi-coherent signal on
which said first and second quasi-coherent
signals are added; and

 determining a first phase of said first
spreading code sequence based on said added
20 quasi-coherent signal.

14. A synchronization establishing and tracking
method according to claim 13, further comprising:

 determining a plurality of target phases
based on said added quasi-coherent signal;

5 selecting a selected phase from among said
plurality of target phases;

 setting said first phase to said selected
phase.

15. A synchronization establishing and tracking
method according to claim 14, wherein said
selecting includes:

 determining an order of priority for said
5 target phases based on said added quasi-coherent
signal; and

 selecting said selected phase based on said
order of priority.

16. A synchronization establishing and tracking

method according to claim 14, wherein said determining said plurality of target phases includes:

- 5 generating a phase determining spreading code sequence such that a phase of said phase determining spreading code sequence is sequentially shifted to one of candidate phases; calculating correlation between said phase
- 10 determining spreading code sequence and said added quasi-coherent signal to determine added signal correlation values respectively corresponding to said candidate phases; and
- selecting said target phases from among
- 15 said candidate phases based on said correlation values.

17. A synchronization establishing and tracking method according to claim 13, further comprising:

- determining a despreading phase based on said first correlation;
- 5 despreading said first quasi-coherent signal to produce a despread signal using another spreading code sequence having said despreading phase;
- detecting a synchronization of said first
- 10 quasi-coherent signal with said another spreading code sequence to output a synchronization

informing signal indicative of said
synchronization; and

fixing said first phase based on said
15 synchronization informing signal such that said
synchronization of said first quasi-coherent
signal with said another spreading code sequence
is established.

18. A synchronization establishing and tracking
method according to claim 13, further comprising:

determining a second phase of said second
spreading code sequence based on said added semi-
5 synchronous.

19. A synchronization establishing and tracking
method according to claim 18, further comprising:

determining a plurality of target phases
based on said added quasi-coherent signal; and
5 setting said first and second phases to a
selected phase selected from among said ranked
phases.

20. A synchronization establishing and tracking
method according to claim 13, further comprising:

determining a first despreading phase based
on said first correlation;
5 despreading said first quasi-coherent

signal to produce a first despread signal using a third spreading code sequence having said first despread phase;

10 determining a second despread phase based on said second correlation;

despread said second quasi-coherent signal to produce a second despread signal using a fourth spreading code sequence having said second despread phase; and

15 identifying a direction of a mobile station transmitting at least one of said first and second received signals, based on said first and second despread signals.

21. A synchronization establishing and tracking method for a CDMA base station comprising:

generating a spreading code sequence;
calculating correlation between said
5 spreading code sequence and a quasi-coherent signal corresponding to a first received signal received by said CDMA base station;

storing a plurality of ranked phases; and
setting said phase to a selected phase
10 selected from among said plurality of ranked phases.

22. A synchronization establishing and tracking

method according to claim 20, further comprising:

adding said quasi-coherent signal and at
least one other quasi-coherent signal to produce
5 an added quasi-coherent signal, wherein said
other quasi-coherent signal corresponds to one or
more other received signal received by the CDMA
station, and

wherein said plurality of ranked phases are
10 determined based on said added quasi-coherent
signal.